Senior Thesis

A Physical and Chemical Analysis of the Outwash Aquifer in the Mad River Valley, Champaign County

by
Lydia Cumming
1995

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the requirments for the degree of
Bachelor at The Ohio State University,
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Approved by:

Michael C. Hansen 6-1-95

Dr. Michael Hansen

ACKNOWLEDGMENTS

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INTRODUCTION

A two year study of the Mad River watershed, conducted by the Ohio Department of Natural Resources (ODNR), Division of Water, started in December, 1993. The goal of the project is to identify surface/ground water relationships in the Mad River watershed by studying the ground water flow and chemistry. The project is expected to be completed in December, 1995. By determining ground water flow fields and ground water chemistry, a better understanding of the occurrence and movement of nonpoint source (NPS) contamination may be possible. NPS is characterized by large scale occurrence of relatively diffuse contaminants which originate from multiple small sources, whose exact locations are not known.

This thesis focuses on the physical and chemical analysis of the sand and gravel aquifer located in the Mad River Watershed in southernmost Logan county and central Champaign county. The

the sand and gravel aquifer located in the Mad River Watershed in southernmost Logan county and central Champaign county. The primary objective is to correlate susceptibility to contamination in respect to lithology, ground water movement, and water chemistry by analyzing the characteristics of the aquifer. This report begins with a physical description of the study area including: location, physiography, geology, ground water movement and static water levels followed by a short discussion on water chemistry. The material and methods used in analyzing ground water chemistry of the Mad River watershed are described. The report concludes by discussing the implications of the results.

PHYSICAL DESCRIPTION

Location

The study area includes a small section of south-central Logan County and most of central Champaign county in west-central Ohio (Figure 1). Land use of the study area is primarily agricultural (Jones, 1995). The population of Champaign County, according to the 1990 Census, is 36,019 (Ohio Department of Development, 1990). The relative position of the wells and river

sampling sites are shown in Figure 2. Appendix A lists the wells and their corresponding identification numbers on record at ODNR.

Physiography

Champaign County is located in the Central Lowland physiographic province, Till Plains section (Fenneman, 1938). Its topography is typical of glaciated Ohio, ranging from flat valleys, to a gently rolling landscape, to hummocky ridges that have been dissected by streams. Maximum relief in Champaign County is approximately 430 feet.

Geology

The geologic history of the area is covered in detail by Quinn and Goldthwait (1979). Prior to glaciation, the Late Tertiary Teays River controlled most of the drainage in southwestern Ohio. Upon the advent of the Pleistocene Epoch, the drainage network was blocked, creating a network of flooded lakes. Eventually new outlets were cut for these lakes. The resulting drainage system, referred to as the Deep Stage Drainage, downcut deeper than the previous Teays Drainage. The

newly formed valleys were subsequently buried by deposits of thick glacial drift. The Pleistocene Epoch (two million to 10,000 years before present) contained four ice advances: the Nebraskan, Kansan, Illinoian, and Wisconsinan. The Wisconsinan, the most recent ice advance, had the greatest impact on the topography.

The Mad River Valley is a deep buried valley with thick deposits of sand and gravel outwash with discontinuous lenses of clay and till. Outwash or valley train deposits are deposited by meltwater from the glacier. The coarse gravel is deposited close to the meltwater source, sand is deposited further downstream, and fine silt and clay are deposited even further from the source. The result is stratified drift composed of well-sorted gravel, sand and sandy alluvium. The highly permeable nature of these sand and gravel deposits make the outwash aquifer within the Mad River valley an excellent source of ground water, but also sensitive to pollution problems.

The Mad River Valley is bordered by uplands composed of ground moraine and end moraine. The ground and end moraines are primarily composed of till, which was directly deposited by the glacier. Till is a dense, compact unsorted material composed of clay, silt, sand, and gravel. Thin, discontinuous lenses of sand

and gravel may be found interbedded within the till.

An east to west cross section of the Mad River Valley (Figure 3), based on well log data and the bedrock topography maps of Swinford (1992a,b), provides a general picture of the aquifer. In addition, the well log of an observation well in West Liberty (near RS1 on Figure 2) represents a typical well log found in the valley (Figure 4).

Ground water movement

The Mad River receives a substantial amount of its recharge from ground water stored in the adjacent extensive sand and gravel deposits. Sheets and Yost (1994) estimated that 60-80% of the Mad River flow was base flow. Base flow is the part of stream discharge resulting from ground water seeping into the stream (Fetter, 1988). The Mad River has the highest sustained dry weather flow in Ohio (Feulner, 1960).

The aquifer receives its recharge from precipitation entering through the soil. Once water reaches the water table, flow direction is dependent upon the lithology and topography of the surface. In areas where the aquifer is shallow and unconsolidated, the movement of ground water is a rapid circulation of water in a local ground water flow systems

(Fetter, 1988). A local ground water flow system has the recharge area at a topographic high and its discharge area at an adjacent topographic low (Domenico and Schwartz, 1990). Deeper sand and gravel wells in the valley may receive some recharge from intermediate flow systems. An intermediate flow system is deeper and has at least one local flow system between its recharge and discharge area (Domenico and Schwartz, 1990). Because of the shallowness of the sand and gravel deposits and the general topography, a regional flow system likely has not developed. Regional flow systems have a recharge area in the basin divide and a discharge area at the valley bottom (Domenico and Schwartz, 1990).

Static water levels

The static water level for a set of residential wells was measured quarterly, beginning in December, 1993. The water level measurements were recorded during the course of a day. Recorded measurements are included in Appendix B. Overall, approximately a four foot drop in water level between December, 1993 and December, 1994 had occurred. Water levels began to rise in March, 1995 in the valley wells and a few of the adjacent upland wells, but none reached the December 1993 levels. An examination

of precipitation records provides a reason why they did not return to previous levels. The annual precipitation average for Urbana for a thirty year period (1961-1990) is about 38 inches (United States Department of Commerce, 1992). Annual precipitation for the 1993 year was about 48 inches - about 10 inches above normal; for the 1994 year, about 28 inches - a departure of about 20 inches.

Figure 5 shows a hydrograph of the ODNR observation well at West Liberty, representing ground water static level fluctuation in a typical valley well. If the depth to the aquifer is shallow or if the outwash sand and gravel deposits are extensive, static water level fluctuations reflect closely the precipitation event (Figure 5). Wells in the adjacent uplands respond slower to precipitation events. In the March 1995 measurements, most of the upland wells did not show an increase in water level. The depth to the aquifer is much greater in the uplands and the presence of thick glacial till prevents the precipitation from quickly reaching the aquifer.

By locating the measured wells in the study area on a topographic 7'30" quadrangle, surface elevation was estimated to within 5 feet of accuracy. The static water level was subtracted from the topographic elevation to determine the elevation head of

the aquifer at a given point. Contouring these values gives an idea of ground water flow direction because water will flow from high to low elevation head, perpendicular to the equipotential line (line of constant head boundary). Figures 6 shows an equipotential map created using the December 1994 static water levels. In general, water flow follows surface topography and its flow is from topographic highs to topographic lows. Therefore, ground water is moving towards the Mad River from the adjacent uplands, while migrating south, downstream along the Mad River and its tributaries.

WATER CHEMISTRY

Dissolution

As water interacts with minerals, it assumes a particular chemical composition (Hem, 1959). The amount of dissolution that occurs within an aquifer depends on the properties of the mineral compostion and the time in which the water is in contact. The dissolution of dolomite, limestone and gypsum, and the oxidation

of pyrite adds Mg^{2+}, Ca^{2+}, SO_4^{2-}, and Fe, respectively, to the water (Fetter, 1988) in the following reactions:

Precipitation and dissolution of limestone:

$$CaCO_3 = Ca^{2+} + CO_3^{2-}$$

Precipitation and dissolution of gypsum:

$$CaSO_4 \cdot 2H_2O(s) = Ca^{2+} + SO_4^{2-} + 2H_2O$$

Sulfide mineral oxidation:

$$4FeS_2 \text{ (pyrite)} + 15O_2 + 14\ H_2O = 4Fe(OH)_2 + 16H + 8SO_4$$

Nitrogen cycle

In addition to the inorganic reactions above, the nitrogen cycle is another important process in affecting water chemistry. Nitrogen from the air is fixed in the soil and converted by plants to amino acids. These are consumed by animals and returned to the soil as nitrogenous waste and then partly oxidized to nitrate (Hem, 1959). When the amount of nitrogenous waste becomes too excessive for plants to uptake, nitrates can accumulate and become a pollutant. Dissolved nitrate can travel through most sediment and rock and enter the aquifer with little attenuation other than dilution (Fetter, 1988).

Chemical analysis of surface and ground waters may vary

laterally and vertically. This variability may aid in determining the provenance of contaminated water and provide insight to which wells will be most affected by contamination and why.

MATERIALS AND METHODS

Wells were chosen for sampling based on their location in relation to the Mad River and on when they were constructed (after 1973). Some of the wells are located in the Mad River Valley; others are located in the uplands adjacent to the valley. Wells were tested quarterly beginning in December, 1993. Water samples were taken from unsoftened outside faucets. Four river samples were collected at sites equally dividing the basin. The samples were stored in plastic containers.

Initial samples were analyzed by the Water Quality Laboratory at Heidelberg College. The water was tested for the following constituents: nitrate, nitrite, ammonia, chloride, sulfate, soluble phosphorus, silica and specific conductance. In addition, the water samples were screened for two common pesticides, Triazine and Alachlor. However, the two pesticides remained at insignificant levels for four sampling periods and

testing for Triazine and Alachlor was discontinued. Appendix C shows the results of the chemical analysis.

Instead, research focused on wells containing elevated levels of nitrate. Two sets of wells were established: the "contaminated" wells, with high levels of nitrate, and the "control" wells, with consistently low levels of nitrate. The two sets were compared to determine whether a difference in water chemistry existed between the two. Because the Kingscreek area showed consistently high levels of nitrate, wells were selected from the area to perform a cation/anion balance. Water samples for the cation/anion comparison were collected in December, 1994 and March, 1995. Coshocton Laboratory analyzed the samples (Appendix D).

Piper Trilinear diagrams were constructed to classify the water according to the relative composition of the major cations and anions. The major ionic species in most natural water are Na^+, K^+, Ca^{2+}, Mg^{2+}, Cl^-, $CO3^{2-}$, $HCO3^-$, and $SO4^{2-}$ (Hem, 1959). By grouping Na and K together, the major cations can be displayed on one trilinear diagram. Likewise, $CO3^{2-}$ and $HCO3^-$ can be grouped to form one trilinear diagram for the major anions. The apex of each triangle represents 100 percent concentration of one of the three cations or anions. The diamond shape field between the two

triangles is used to represent the composition of water with respect to both cations and anions. The water can then be classified by its major constituents (Fetter, 1988).

Three Piper Trilinear diagrams have been included. All the samples were classified as Ca^{2+}/Mg^{2+} bicarbonate water. Well 21, a limestone well, varied the greatest from the bicarbonate water type (Figures 7, 8, and 9). The results were also placed on graphs in order to visually compare water chemistry between wells and river sites (Figure 10).

Because the outwash and bedrock are composed mostly of carbonate, both surface and ground waters are oversaturated with respect to bicarbonate. As a result, determining the provenance of contaminants by separating the aquifer into hydrochemical facies was not possible. However, even though a source of contamination could not be determined, a better understanding of the susceptibility of a well to nonpoint source contamination was achieved through the physical and chemical analysis.

DISCUSSION

Occurrence and Movement of Nitrate

Nitrates are a particular concern in agricultural areas.

Sources for nitrates include nitrate-based fertilizers, animal feed lots and faulty septic tank systems. The United States Environmental Protection Agency (EPA) safe drinking water standards are 10 milligrams per liter (mg/l). Most of the wells and river sites sampled fell below these limits. However, some of the residential wells exceeded 10 mg/l. Also, nitrate level fluctuated; some samples that did not exceed safety levels in one sampling exceeded 10 mg/l in the next.

The maximum levels of nitrates were recorded for each sampling site (Figure 11). Most of the sampling sites with high levels of nitrates occur in the Mad River Valley and the Kingscreek area. Few wells in the adjacent uplands showed elevated nitrate levels.

One explanation for elevated nitrate levels in the wells adjacent to the Mad River and Kingscreek is that the wells are shallow. Shallow wells are more susceptible to contamination because the nitrate quickly enters the upper surface of the aquifer though the overlying soil horizon. Figure 12 shows the inverse relationship between the level of nitrate for March, 1995 and the length of the well casing. Well casing is a solid piece of pipe, typically steel or PVC plastic, used to keep the well open in the unconsolidated aquifer. The length of the well

casing represents the depth from which the water is being extracted.

The equipotential map (Figure 6) provides an idea of what direction a contaminant, such as nitrate, may move upon entering the water table. Contaminated wells often occur in groups, reflecting the contaminants path.

CONCLUSION

Chemical classification did not aid in determining the origin of the NPS contaminant, nitrate. Instead, one hydrochemical facies appear to be present within the outwash sand and gravel. However, the results from the chemical analysis show how the chemistry in an aquifer may vary both laterally and vertically. This study provided an opportunity to examine the relationship between lithology, ground water movement and ground water chemistry and how these factors may be applied in studying NPS contamination such as nitrate.

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Figure 1.


Williams
Fulton
Lucas
Wood
Ottawa
Henry
Sandusky
Erie
Lorain
Cuyahoga
Lake
Geauga
Ashtabula
Trumbull
Defiance
Seneca
Huron
Medina
Summit
Portage
Mahoning
Paulding
Putnam
Hancock
Ashland
Wyandot
Crawford
Richland
Wayne
Stark
Columbiana
Van Wert
Allen
Hardin
Carroll
Mercer
Auglaize
Marion
Morrow
Holmes
Tuscarawas
Jefferson
Knox
Shelby
Logan
Union
Delaware
Coshocton
Harrison
Darke
Champaign
Licking
Guernsey
Belmont
Miami
Madison
Franklin
Muskingum
Clark
Fairfield
Perry
Noble
Monroe
Preble
Greene
Pickaway
Morgan
Fayette
Hocking
Washington
Butler
Warren
Clinton
Ross
Athens
Vinton
Highland
Meigs
Hamilton
Clermont
Pike
Jackson
Gallia
Brown
Adams
Scioto
Lawrence
ADAMS
HARRISON
SALEM
WAYNE
RUSH
JOHNSON
CONCORD
JACKSON
MAD RIVER
URBANA
URBANA
UNION
GOSHEN

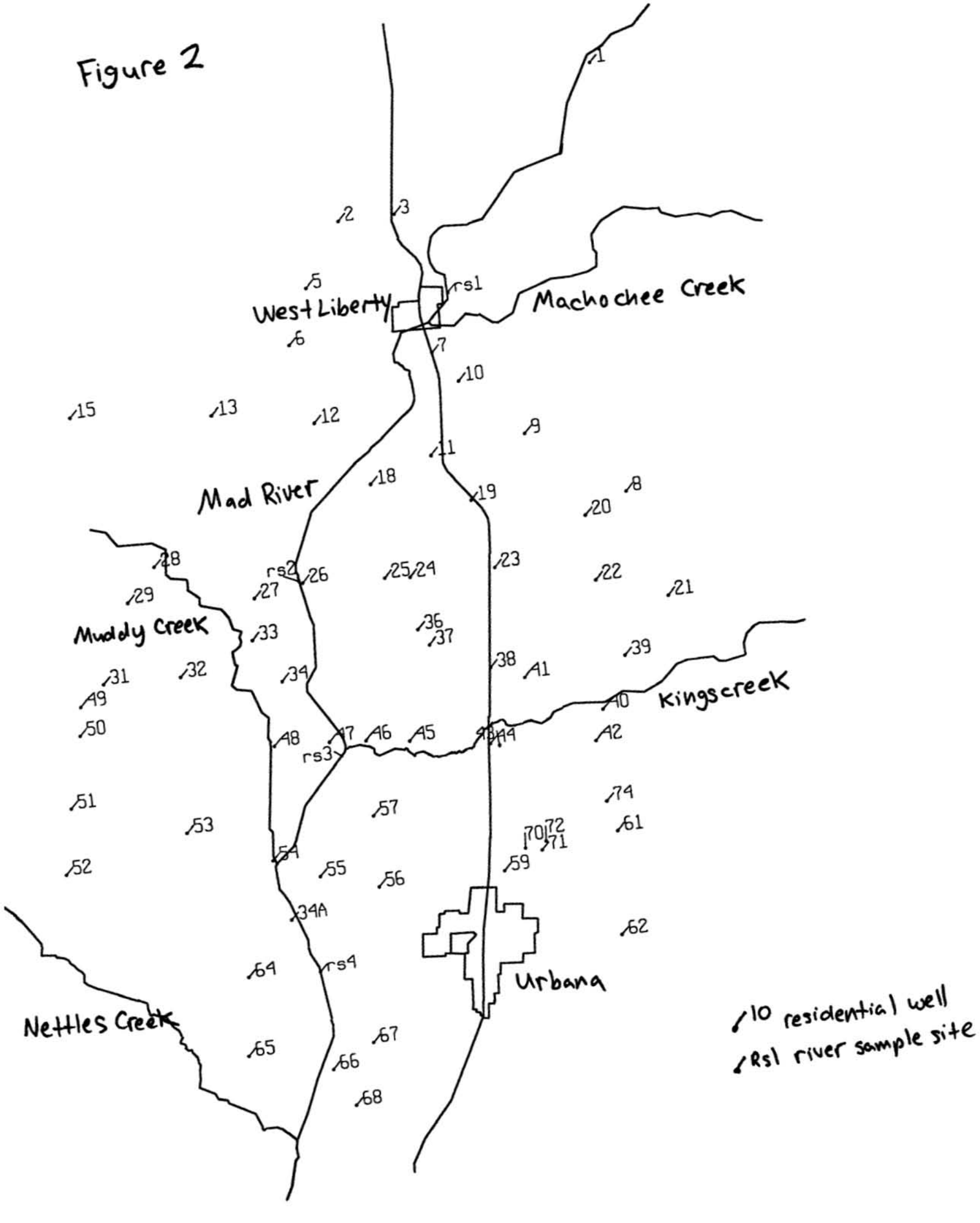
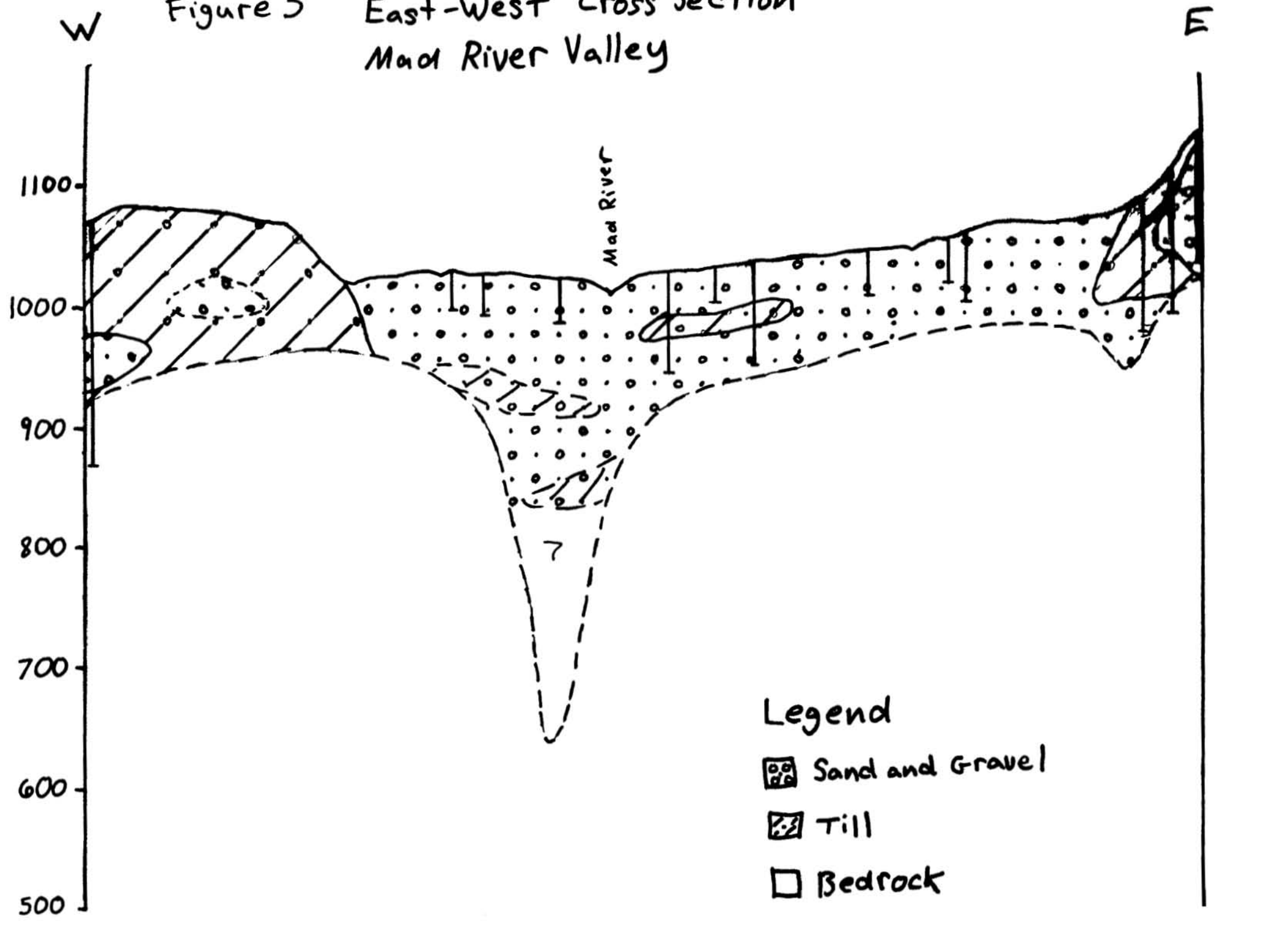


Figure 2
West Liberty
Mad River
Muddy Creek
Nettles Creek
Machochee Creek
Kingscreek
Urbana
10 residential well
Rs1 river sample site

Figure 3 East-West Cross Section
Mad River Valley



TYPE OR USE PEN
SELF TRANSCRIBING
PRESS HARD

Ohio Department of Natural Resources, Divison of Water
1939 Fountain Square Drive, Columbus, Ohio 43224 Phone (614) 265-6739

Permit Number _____

Figure 4.

COUNTY LOGAN TOWNSHIP LIBERTY SECTION/LOT No. XXXX S (CIRCLE ONE)

OWNER/BUILDER XXXXXXX CITY W LIBERTY (LIONS CLUB) PROPERTY ADDRESS STATE ROUTE 245 EAST
(CIRCLE ONE OR BOTH) (ADDRESS OF WELL LOCATION A)

LOCATION OF PROPERTY LIONS CLUB PARK, EAST SIDE OF WEST LIBERTY

CONSTRUCTION DETAILS

CASING
Borehole Diameter 7-7/8 in.
X 1 Diameter 6 in. Length 60 ft. Wall Thickness SDR 17 in.
X 2 Diameter 8 in. Length 7' 8" ft. Wall Thickness _____ in.
Type: X 2 Steel; 1 2 Galv.; 1 X 2 PVC; 1 2 Other _____
Joints: X 1 2 Threaded; 1 2 Welded; 1 2 Solvent; X 1 2 Other CERTA LOK
Liner: Length _____ Type _____ Wall Thickness _____ in.

SCREEN
Type (wire wrapped, louvered, etc.) MACHINE SLOT Material PVC
Length 12 ft. Diameter 6 in.
Set between 71 ft. and 59 ft. Slot 0.050 in.

GROUT
Material BENSEAL/EZ MUD Volume used 105 GAL
Method of installation 1" TREMIE TUBE
Depth: placed from 50 ft. to SURFACE ft.

GRAVEL PACK (Filter Pack)
Material #4 PARRY SAND Volume used 900 LBS
Method of installation GRAVITY
Depth: placed from 72 ft. to 50 ft.

Pitless Device X Adapter ☐ Preassembled unit
Use of Well OBSERVATION WELL
X ☐ Rotary ☐ Cable ☐ Augered ☐ Driven ☐ Dug ☐ Other _____
Date of Completion 05/27/94

WELL LOG*

INDICATE DEPTH(S) AT WHICH WATER IS ENCOUNTERED.

Show color, texture, hardness, and formation: sandstone, shale, limestone, gravel, clay, sand, etc.	From	To
TOP SOIL	0	2
SAND & GRAVEL	2	33
GRAY SANDY CLAY & GRAVEL	33	43
GRAY CLAY	43	45
SAND & GRAVEL	45	72

Note: Well log is approximate, based on driller's general description of materials and approx. depths.

If additional space is needed to complete well log, use next consecutively numbered form.

WELL TEST

☐ Bailing ☐ Pumping* X Other AIR LIFT
Test rate 200 gpm Duration of test 1 hrs.
Drawdown 20 ft.
Measured from: ☐ top of casing X ground level ☐ Other _____
Static Level (depth to water) 8.25 ft. Date: 05/27/94
Quality (clear, cloudy, taste, odor) CLEAR

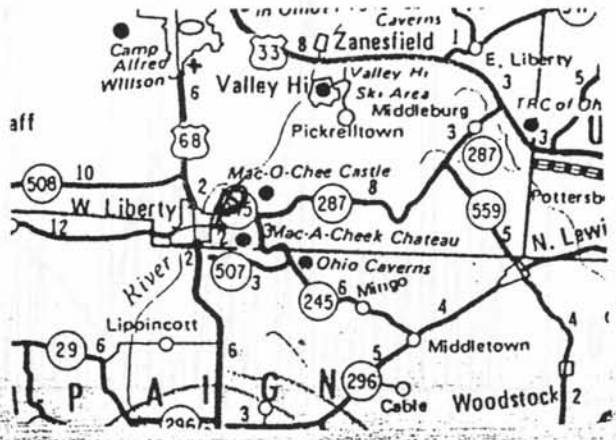
*(Attach a copy of the pumping test record, per section 1521.05, ORC)

PUMP

Type of pump _____ Capacity _____ gpm
Pump set at _____ ft.
Pump installed by _____

SKETCH SHOWING WELL LOCATION

Show distances well lies from numbered state highways, street intersections, county roads, etc.



I hereby certify the information given is accurate and correct to the best of my knowledge.

Drilling Firm SPROWLS DRILLING COMPANY
Signed _____
Address 565 WEST CHERRY STREET; P.O. BOX 107
Date 6/7/94
City, State, Zip SUNBURY OH 43074 1731
ODH Registration Number _____

5548

Completion of this form is required by section 1521.05, Ohio Revised Code - file within 30 days after completion of drilling.
ORIGINAL COPY TO - ODNR, DIVISION OF WATER, 1939 FOUNTAIN SQ. DRIVE, COLS., OHIO 43224
Blue - Customer's copy Pink - Driller's copy Green - Local Health Dept. copy

Figure 5

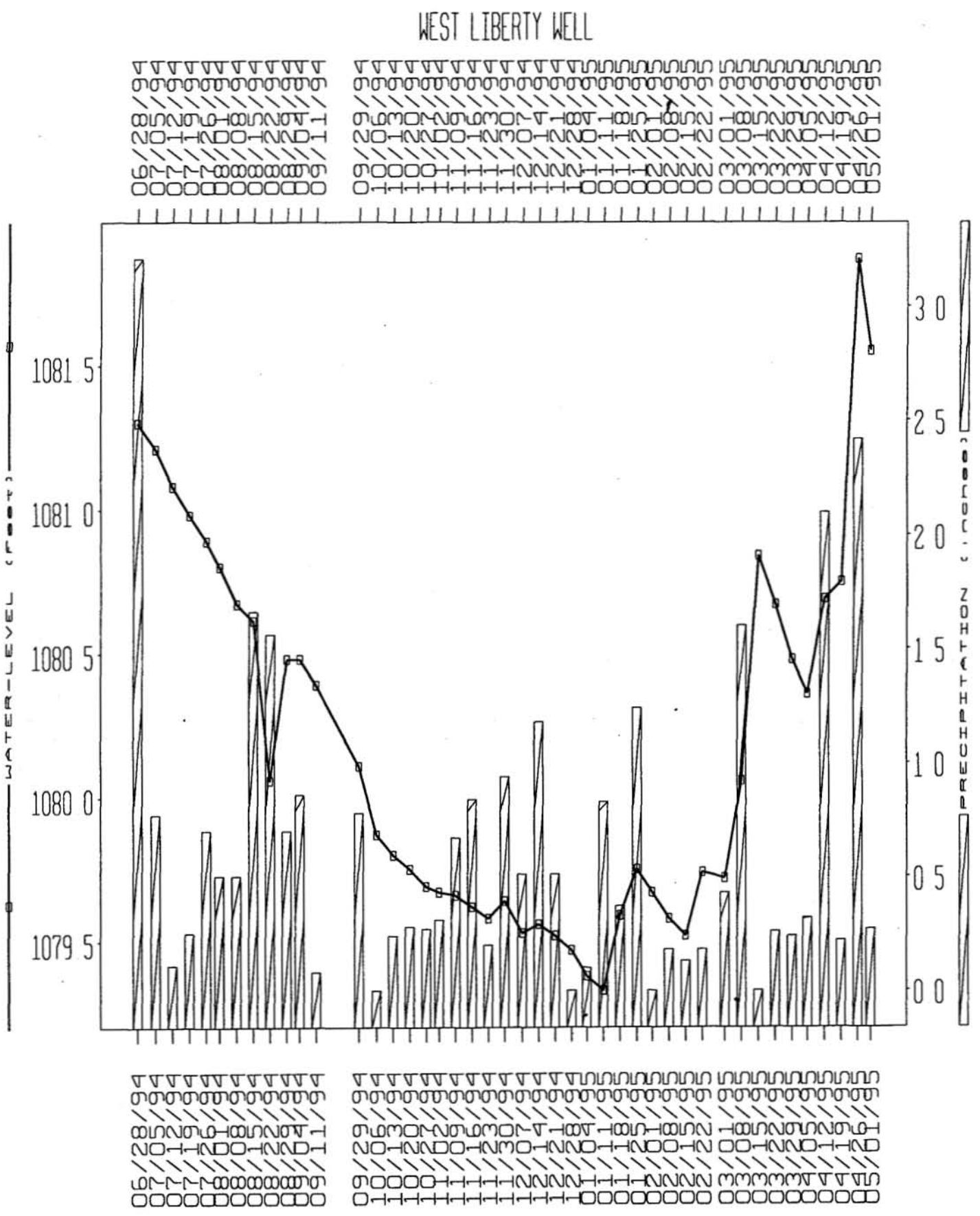

WEST LIBERTY WELL
WATER-LEVEL (FEET)
1081 5
1081 0
1080 5
1080 0
1079 5
PRECIPITATION (INCHES)
3 0
2 5
2 0
1 5
1 0
0 5
0 0

Figure 6 Equipotential Map December, 1994

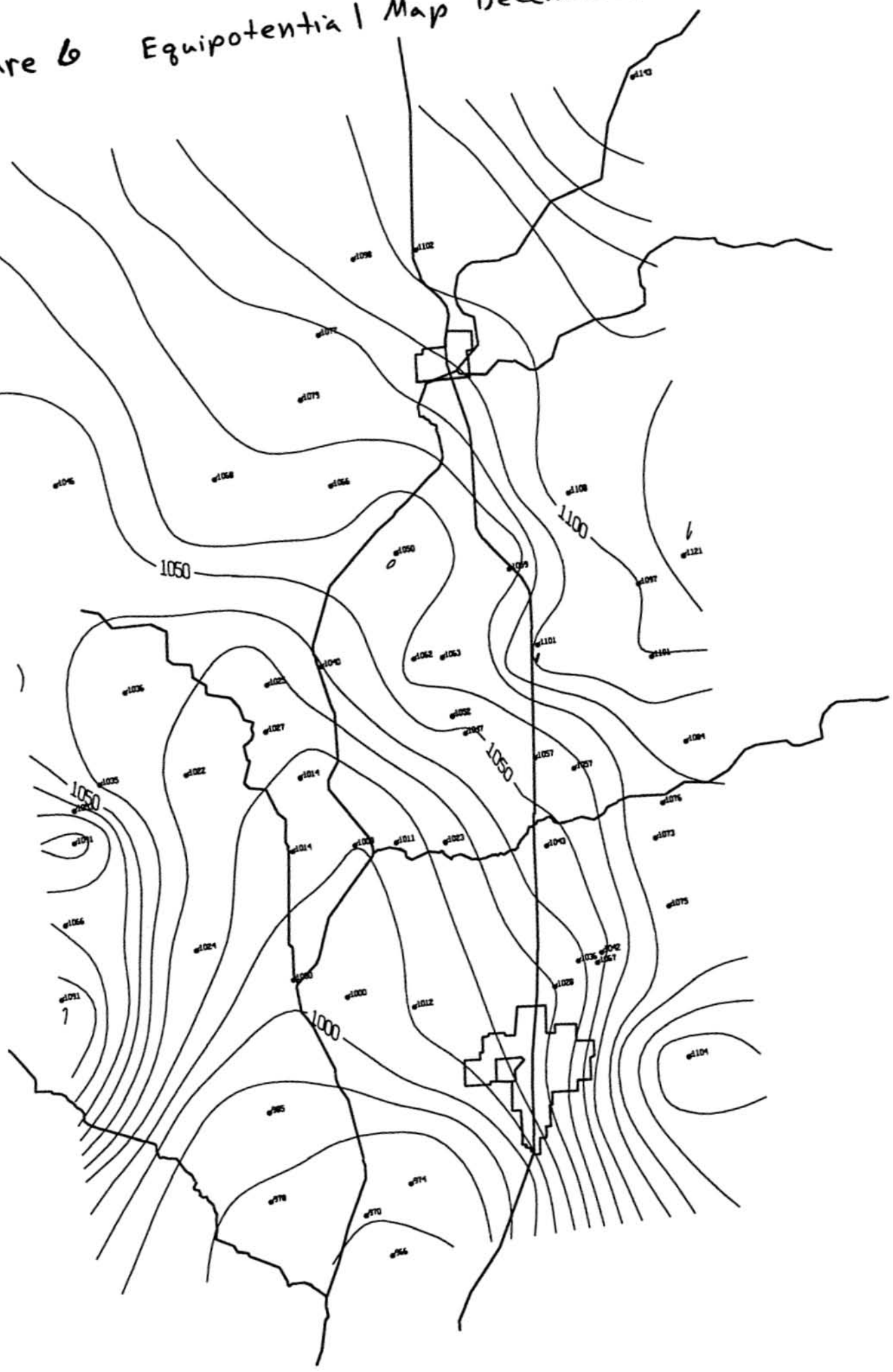


Figure 7

Data Set #1

○ M10(12/08/94)

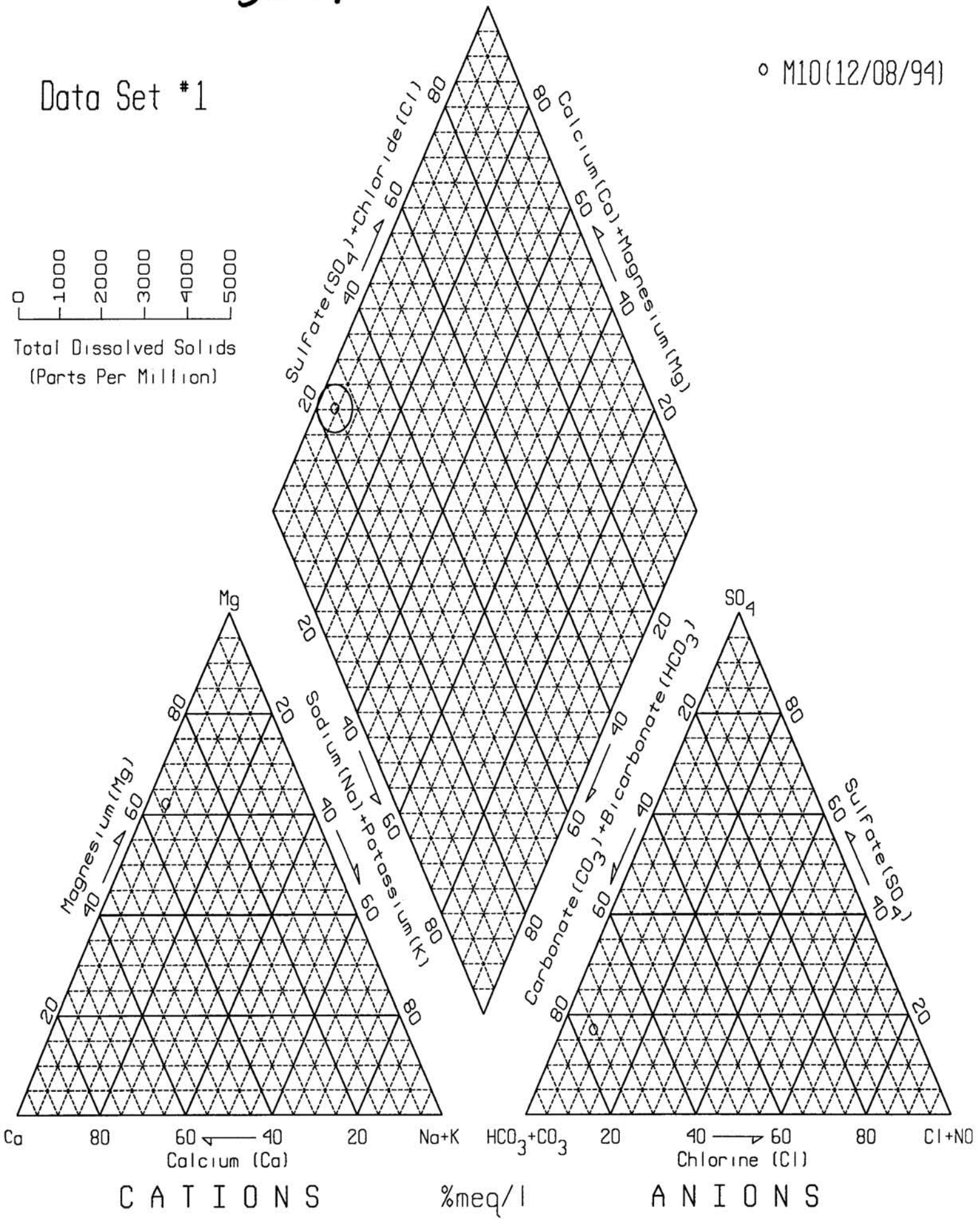


Figure 8

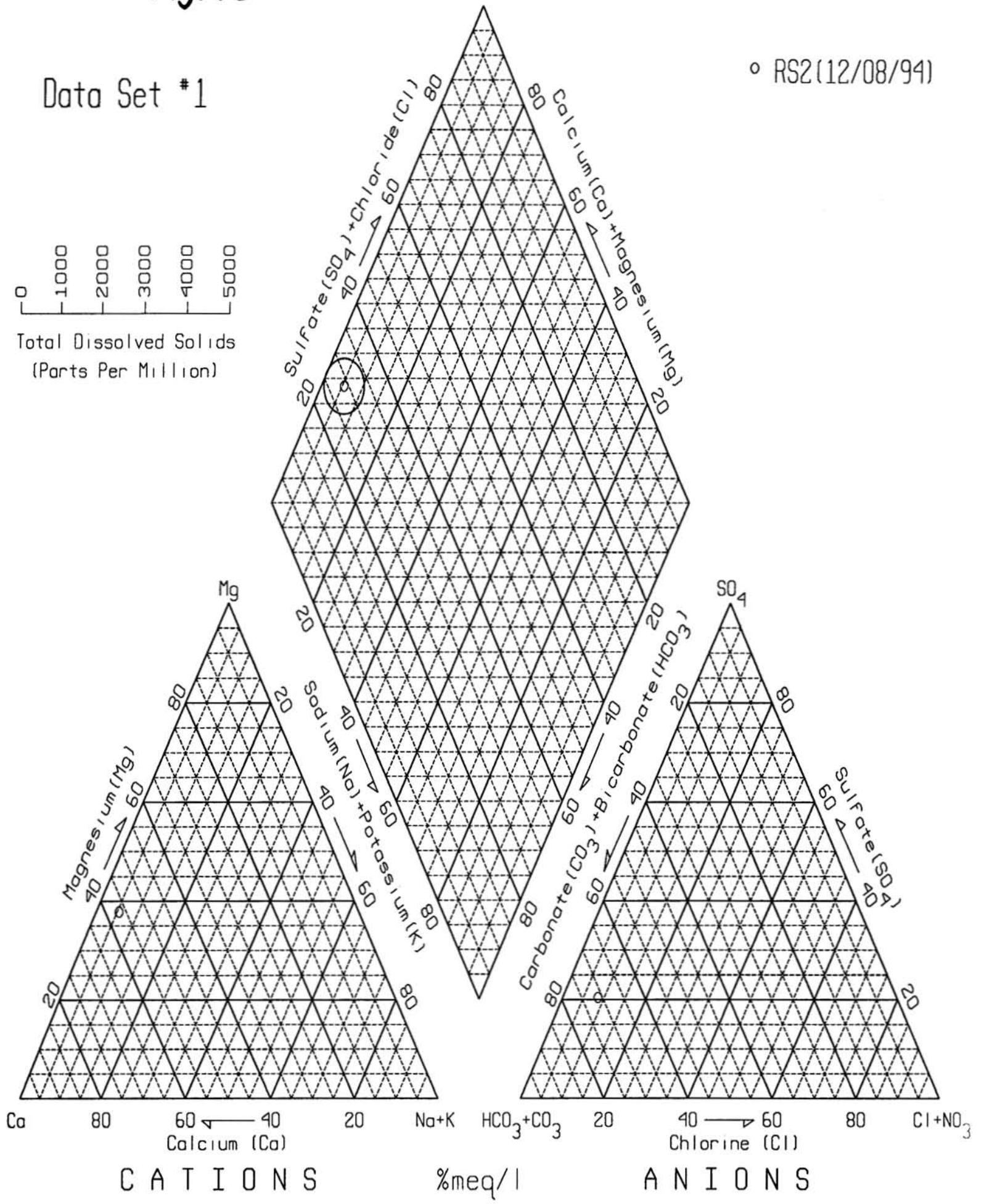

Data Set #1
o RS2(12/08/94)
0
1000
2000
3000
4000
5000
Total Dissolved Solids
(Parts Per Million)
Sulfate(SO4)+Chloride(Cl)
Calcium(Ca)+Magnesium(Mg)
Mg
Magnesium(Mg)
Sodium(Na)+Potassium(K)
SO4
Carbonate(CO3)+Bicarbonate(HCO3)
Sulfate(SO4)
Ca
Na+K
Calcium (Ca)
HCO3+CO3
Cl+NO3
Chlorine (Cl)
CATIONS
%meq/l
ANIONS

Figure 9

Data Set #1

○ M21 (12/08/94)

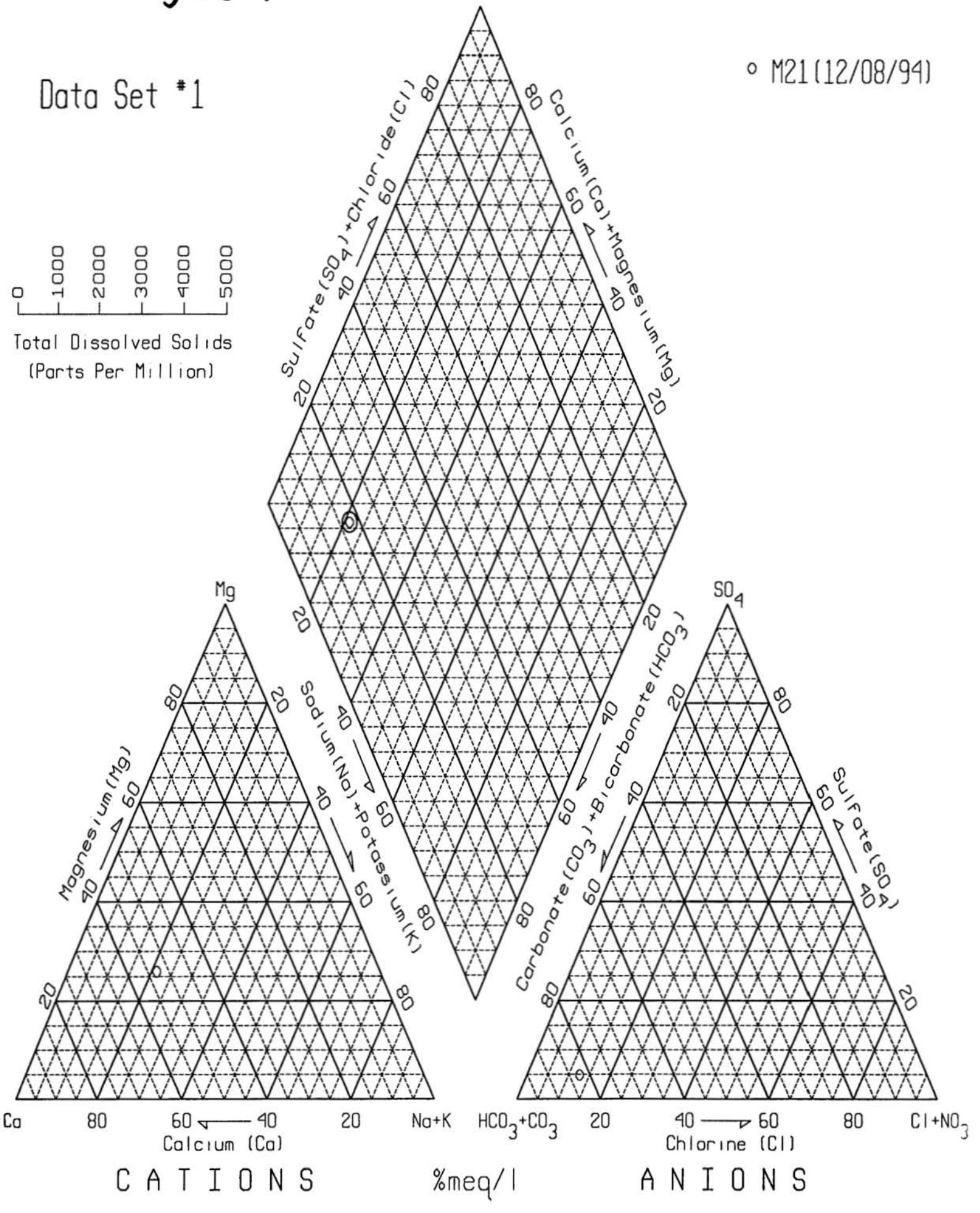


Figure 10

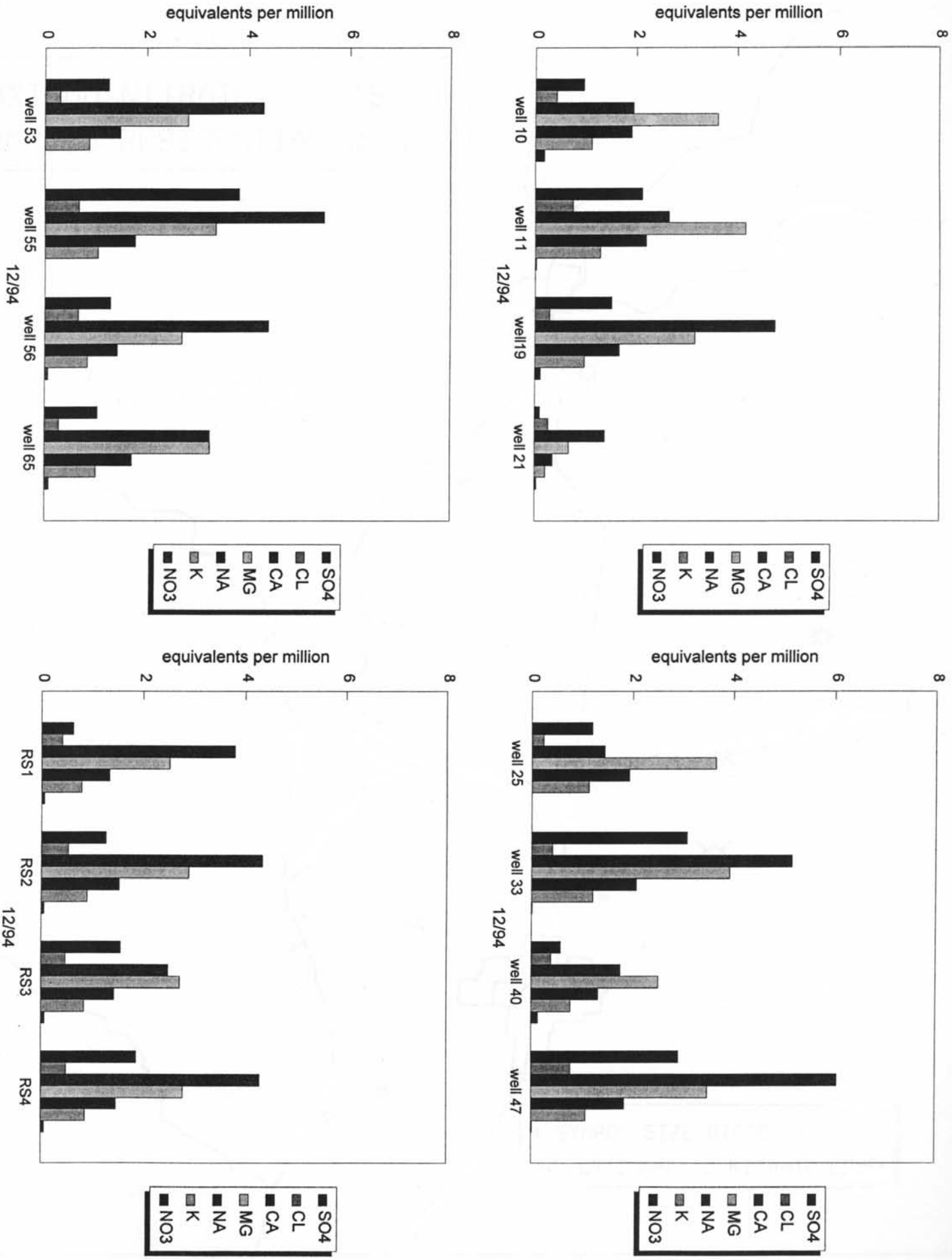

equivalents per million
0
2
4
6
8
well 10
well 11
well19
well 21
12/94
SO4
CL
CA
MG
NA
K
NO3
equivalents per million
0
2
4
6
8
well 53
well 55
well 56
well 65
12/94
SO4
CL
CA
MG
NA
K
NO3
equivalents per million
0
2
4
6
8
well 25
well 33
well 40
well 47
12/94
SO4
CL
CA
MG
NA
K
NO3
equivalents per million
0
2
4
6
8
RS1
RS2
RS3
RS4
12/94
SO4
CL
CA
MG
NA
K
NO3

Figure 11

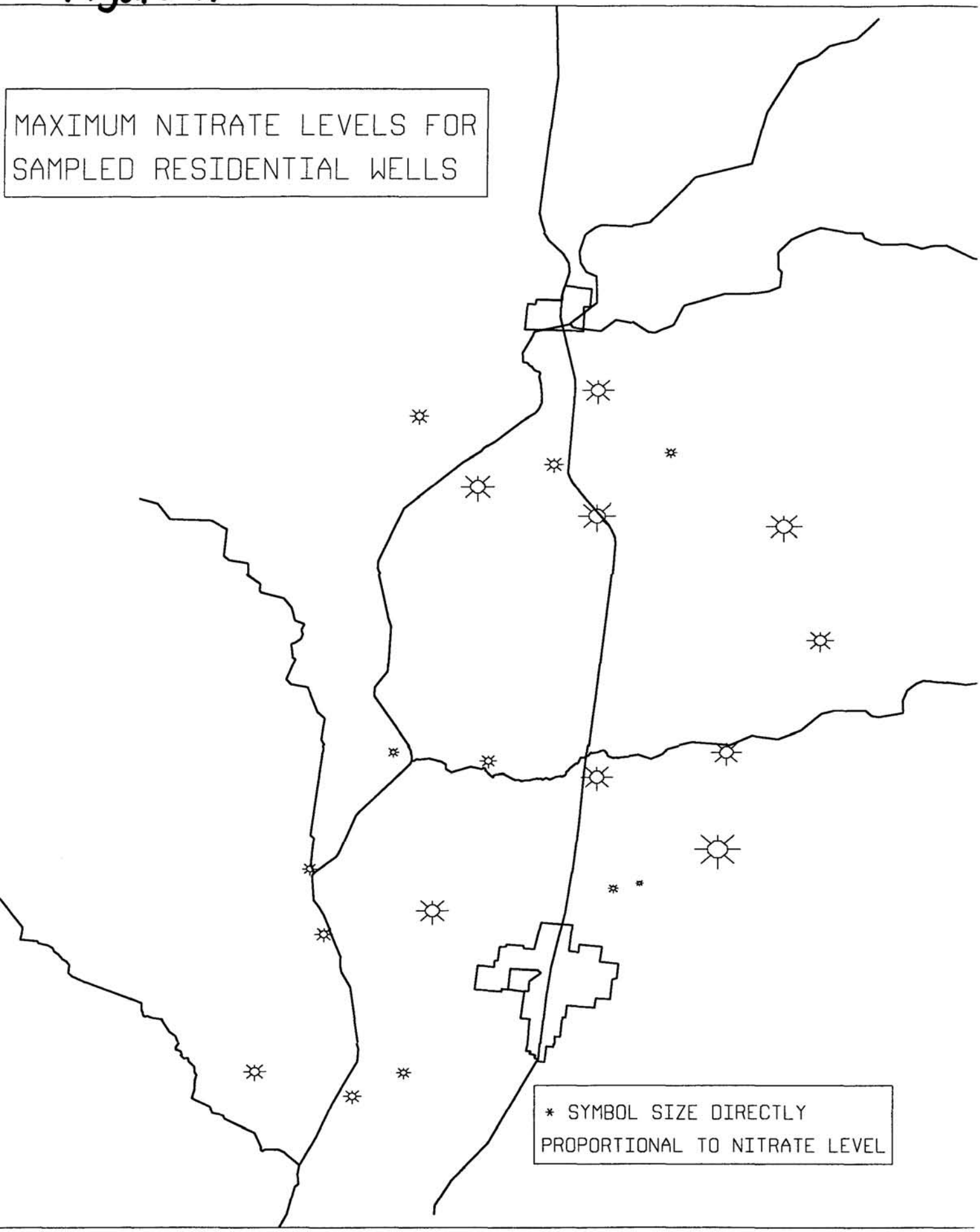
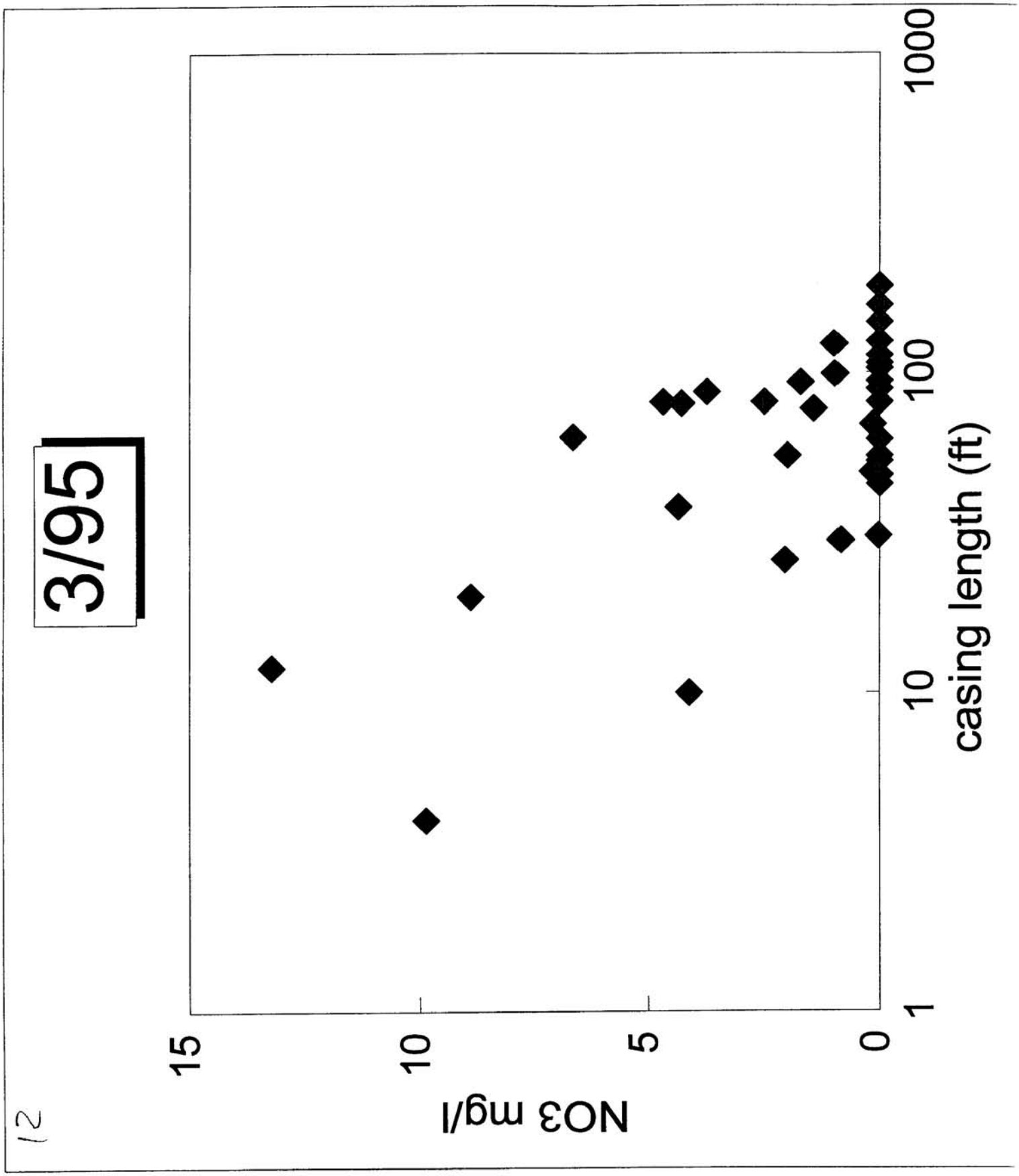

MAXIMUM NITRATE LEVELS FOR
SAMPLED RESIDENTIAL WELLS
* SYMBOL SIZE DIRECTLY
PROPORTIONAL TO NITRATE LEVEL

Figure 12



12

MAD RIVER NPS PROJECT

NPS NUMBER	WELL LOG NUMBER	NPS NUMBER	WELL LOG NUMBER	NPS NUMBER	WELL LOG NUMBER
1	737160	36	736362	66	749310
2	568979	37	568958	67	668890
3	653534	38	640224	68	436608
5	630456	39	689826	70	640293
6	774766	40	568972	71	718706
7	696647	41	705958	72	738383
8	759428	42	712525	74	712336
9	736385	43	753580		
10	749317	44	488985		
11	685541	45	732284		
13	733074	46	732285		
15	736423	47	597256		
18	644028	48	692896		
19	690178	49	699221		
20	742784	50	650644		
21	670265	51	668887		
22	714199	52	662615		
23	694474	53	736343		
24	703920	54	652357		
25	357672	55	634626		
26	686969	56	640435		
27	738395	57	539389		
28	678714	58	419315		
29	456618	59	591420		
30	705952	60	718706		
31	697663	61	659754		
32	753623	62	479384		
33	654936	63	288378		
34	700056	64	719784		
34A	N/A	65	539391		

Appendix A

Appendix B

WATER LEVELS

	12/93	3/94	6/94	9/94	12/94	3/95
1		1148.00	1145.23	1143.25	1144.60	1120.05
2	1101.14	1101.32	1100.17	1098.14	1096.75	1095.72
3	1105.04	1105.34	1104.52	1102.10	1100.57	1099.27
5	1079.22	1078.98	1078.00	1076.52	1075.52	1074.79
6	1079.52	1080.37	1079.34	1078.69	1078.04	1077.55
7	1074.52	1073.05	1071.95	1070.85	1070.25	1071.43
8	1123.32	1124.02	1123.10	1121.05	1119.32	1117.47
9	1079.50	1079.52	1078.94	1108.00	1077.25	1076.50
10	1074.31	1072.80	1071.70	1072.12	1069.80	1070.90
11	1059.05	1057.39	1056.62	1056.27	1055.87	1057.12
12	1065.30	1064.57	1072.50	1066.00	1062.19	1062.50
13	1070.42	1070.00	1069.42	1068.00	1067.00	1067.28
15	1048.37	1048.17	1047.25	1046.45	1044.54	1044.60
18	1052.12	1050.58	1049.54	1049.55	1049.40	1049.70
19				1059.50	1058.55	1058.40
20	1098.14	1098.25	1097.89	1097.05	1096.28	1095.07
21	1106.32	1106.40	1106.25		1103.40	
22	1101.75	1101.87	1101.75	1100.92	1100.53	1099.80
23	1066.47	1066.30	1065.48	1064.03	1062.88	1062.18
24	1064.90	1064.10	1063.70	1063.20	1062.99	1062.84
25	1064.00	1061.62	1061.70	1061.60	1061.39	1062.24
26	1041.90	1041.28	1040.85	1040.50	1039.75	1040.47
27	1025.48	1024.82	1024.37	1024.90	1023.77	1024.72
28	1030.29	1029.72	1029.00		1028.25	1029.45
29	1038.28	1037.80	1037.00	1036.41	1034.92	1036.15
31	1035.71	1035.91	1077.83	1035.23	1034.13	1034.08
32	1025.75	1025.22	1023.85	1022.50	1021.80	1024.65
33	1029.85	1028.75	1028.05	1027.15	1026.65	1027.80
34	1017.26	1016.38	1015.78	1014.20	1014.75	1016.04
34A	1003.27	1002.68				
36		1053.25	1052.90	1051.85	1051.35	1050.96
37	1049.44	1048.96	1048.85	1047.31	1046.70	1046.42
38	1059.80	1059.80	1058.17	1057.28		1055.68
39	1085.46	1085.04	1084.71	1084.32	1083.67	1083.54
40	1078.09	1077.55	1077.09	1076.42	1076.02	1076.20
41		1059.90	1059.06	1057.30	1056.02	1055.36
42	1075.40	1075.30	1074.77	1073.08	1072.10	1071.80
43	1045.54	1045.33	1044.58	1043.07	1042.02	1041.64
44		1055.50	1054.76		1052.32	1052.03
45	1024.46	1023.75	1023.24	1022.61	1022.32	1022.98
46		1012.50	1012.00	1011.25	1010.94	1012.00
47	1011.11	1009.45	1009.10	1008.59	1008.39	1009.84
48		1015.85	1014.93	1014.17	1013.92	1015.78
49	1055.04	1054.79	1054.08	1052.55	1051.80	1052.48
50		1095.42	1092.71	1091.24	1089.57	
51	1068.16	1068.04	1067.92	1066.28	1065.08	1064.36
52	1093.08	1093.82	1094.19	1091.37	1090.25	1090.31
53	1050.40	1026.43	1025.72	1024.29	1023.47	1024.60
54	1002.25	1002.03	1001.22	1000.43	1000.69	1001.82
55	1002.24	1002.05	1001.24	1000.43	1000.78	1001.86
56	1014.01	1014.23	1013.96	1012.30	1011.36	1010.97
57	1009.06		1007.93		1006.98	1007.45
59	1029.91	1027.70	1029.52	1027.70	1026.58	1025.96
61	1084.69	1087.27	1086.73			
62		1105.64	1105.42	1104.00	1102.62	
64	987.78	987.05	986.28	984.61	983.94	985.39
65	980.28	979.90	979.40	978.21	977.82	978.80
66	971.50	971.32	970.76	970.25	969.62	969.92
67	975.55	975.53		974.38	973.25	972.92
68		968.02	967.34	966.15	965.89	966.17
70				1036.07	1034.99	1034.58
71				1066.82	1066.14	1066.01
72				1042.02	1040.86	
74				1074.90	1074.18	

Appendix C

Date 12/01/93

NPS	ID	NAME	NO23	NO2	NH3	CL	SO4	COND	SRP	SIO2	TRISCR	ALASCAR
RS1	61820	River Sample	1.26	0.000	0.014	5.1	19.2	252	-0.002	3.88	0.02	0.07
RS2	64569	River Sample	1.23	0.000	0.019	4.5	19.5	249	-0.004	3.86	0.01	0.07
RS3	53316	River Sample	4.02	0.004	0.002	12.7	57.1	591	0.000	7.60	0.02	0.20
RS4	65216	River Sample	4.09	0.003	0.000	14.5	73.8	761	0.001	8.73	0.01	0.20
3	63568	Littleton Funeral Home	0.05	0.000	0.000	14.5	62.4	750	-0.002	12.16	0.00	0.01
6	64039	2451 St Rt 245	0.01	0.000	0.006	11.4	70.4	708	-0.002	12.56	0.00	0.01
8	64390	KENNEDY	9.97	0.000	0.105	15.5	34.0	798	0.015	9.63	0.01	0.02
9	64532	LAPP	3.32	0.003	0.006	24.8	78.2	788	0.002	11.99	0.00	0.01
10	61669	J. DETWILER	0.13	0.000	0.418	13.6	52.4	715	-0.001	5.84	0.00	0.02
11	65416	T. DETWILER	5.07	0.000	0.009	27.6	84.0	604	-0.004	6.78	0.01	0.24
12	64726	CARNEY	5.65	0.000	0.002	18.7	42.5	791	-0.002	13.25	0.00	0.01
13	65226	MOWREY	0.00	0.000	0.009	3.2	25.4	245	0.002	3.84	0.01	0.01
18	63946	6501 Upper Valley Pike	2.48	0.000	0.006	5.2	24.9	231	0.001	2.77	0.00	0.03
19	65317	6709 Kanagy Rd	9.52	0.000	0.013	15.7	55.1	800	-0.002	11.48	0.01	0.05
21	64957	NELSH	7.83	0.000	0.005	14.3	35.7	424	0.007	5.20	0.01	0.02
22	65863	SCHILLIGER	0.02	0.000	0.044	4.8	27.5	406	-0.004	13.78	0.00	0.01
24	65692	850 Lippencott Rd	0.19	0.000	0.006	2.3	12.9	356	-0.005	5.86	0.00	0.01
25	63958	TULLIS	0.00	0.000	0.020	9.3	49.3	684	-0.002	14.15	0.00	0.01
26	64869	2273 Lippencott Rd	0.00	0.000	0.184	2.2	12.8	666	0.008	16.13	0.00	0.01
27	64885	FINCH	0.00	0.000	0.017	10.1	59.8	750	-0.003	13.88	0.00	0.01
30	64950	5965 Calland Rd	0.00	0.000	0.112	4.0	30.0	661	-0.001	17.36	0.00	0.01
33	64863	BROWN	0.00	0.000	0.015	14.7	139.1	846	0.005	9.97	0.01	0.03
34A	65304	SMITH/TOLLEY	4.99	0.011	0.000	15.0	62.9	730	-0.004	9.10	0.00	0.01
34	64875	ROUSH	0.00	0.000	0.099	19.5	124.6	849	0.001	13.88	0.01	0.02
37	65526	4497 Ridge Rd	0.00	0.000	0.027	6.7	37.2	642	-0.003	12.56	0.00	0.01
42	65634	WHITE	0.00	0.000	0.010	17.6	35.6	688	0.000	13.24	0.00	0.01
43	63842	141 E St Rt 296	6.78	0.001	0.000	9.9	27.6	643	-0.004	8.28	0.00	0.01
45	65566	FREDERICK	4.30	0.001	0.000	15.4	53.1	724	-0.002	11.60	0.00	0.01
47	65511	SOMMERS	1.34	0.000	0.009	8.7	40.7	379	-0.004	3.21	0.00	0.02
51	65525	BAILEY	0.00	0.000	0.255	1.3	4.3	256	0.002	10.54	0.00	0.01
53	65517	1755 N Rt 560	0.00	0.000	0.041	8.4	55.6	688	-0.001	14.09	0.01	0.01
55	64541	STICKLEY	0.00	0.000	0.047	22.8	152.3	933	-0.001	14.45	0.01	0.39
56	65523	CRAIG	9.31	0.000	0.000	21.2	39.7	728	0.000	10.06	0.01	0.02
57	63779	EARNHART	0.02	0.000	0.088	7.4	55.1	706	0.001	14.25	0.01	0.01
58	63786	201 Fulton St	11.30	0.002	0.000	16.8	52.4	783	-0.003	9.31	0.00	0.01
61	62114	OH VALLEY FARMS	0.00	0.000	0.243	5.2	35.0	621	-0.003	13.34	0.00	0.01
64	65568	3315 W Rt 36	0.00	0.000	0.050	10.6	77.1	720	-0.004	6.95	0.00	0.20
64A	63427	3154 Rt 36	0.00	0.000	0.032	22.4	96.8	865	-0.003	8.87	0.00	0.41
65	63812	MAYSE	6.38	0.000	0.002	9.4	34.2	698	-0.004	11.85	0.00	0.01
66	61995	1855 St Rt 55	4.85	0.000	0.008	32.4	35.8	792	-0.003	11.75	0.00	0.01
67	65156	1510 St Rt 55	3.70	0.000	0.000	31.0	37.3	776	-0.004	12.54	0.00	0.01

Appendix C

Date 6/15/94

NPS	ID	NAME	NO23	NO2	NH3	CL	SO4	COND	SRP	SIO2	TRISCR	ALASCAR
RS1	64699	River Sample	3.64	0.039	0.013	12.7	44.1	758	0.002	9.09	0.03	0.13
RS2	65982	River Sample	3.97	0.024	0.020	14.5	58.2	790	0.002	9.16	0.09	0.34
RS3	65944	River Sample	5.06	0.012	0.001	14.0	58.2	792	0.001	8.85	0.05	0.33
RS4	66009	River Sample	4.04	0.012	0.016	14.2	66.4	761	0.001	8.83	0.07	0.32
1	65406	5025 Rt. 166	0.00	0.000	0.137	1.2	23.4	554	0.002	11.03	0.01	0.08
3	65347	Littleton Funeral Home	0.00	0.000	0.025	14.9	64.0	816	0.002	12.31	0.01	0.06
6	64703	2451 St Rt 245	0.00	0.000	0.000	11.0	75.2	770	0.001	12.79	0.01	0.06
8	65966	KENNEDY	0.00	0.000	0.000	14.3	54.6	909	0.004	9.45	0.30	0.28
9	64729	LAPP	3.48	0.000	0.000	25.1	81.6	736	0.000	11.71	0.01	0.06
10	66069	J. DETWILER	7.68	0.158	0.021	11.8	55.3	819	0.001	9.35	0.01	0.06
11	65937	T. DETWILER	4.26	0.000	0.000	28.1	93.3	931	0.000	8.62	0.01	0.85
12	64728	CARNEY	4.79	0.000	0.000	17.8	45.2	686	0.001	12.81	0.02	0.09
13	66078	MOWREY	0.00	0.000	0.022	11.6	81.9	834	0.002	11.19	0.01	0.05
18		6501 Upper Valley Pike										
19	66043	6709 Kanagy Rd	8.73	0.122	0.000	15.3	54.3	839	0.001	11.27	0.03	0.38
21	55463	NELSH										
22	63941	SCHILLIGER	0.00	0.000	0.000	3.9	34.7	743	0.002	16.09	0.03	0.07
23	66050	126 Short Game Farm Rd	0.00	0.000	0.000	9.6	66.6	589	0.001	12.59	0.01	0.06
24	66067	850 Lippencott Rd	0.00	0.000	0.000	4.3	29.8	710	0.003	13.93	0.20	0.22
25	66074	TULLIS	0.00	0.000	0.017	8.7	48.6	750	0.001	14.07	0.01	0.04
26	65983	2273 Lippencott Rd	0.00	0.000	0.088	1.8	11.0	727	0.003	15.61	0.01	0.08
27	48298	FINCH										
28	65959	5601 Church Rd	0.00	0.000	0.007	4.1	53.4	952	0.001	18.18	0.01	0.04
29	65979	4861 W St Rt 29	0.00	0.000	0.306	1.7	16.6	676	0.002	14.91	0.02	0.12
33	65946	BROWN	0.53	0.000	0.000	12.6	124.6	923	0.001	9.82	0.01	0.11
34A	64216	SMITH/TOLLEY										
34	65953	ROUSH	0.00	0.000	0.098	20.8	122.0	910	0.003	13.56	0.01	0.06
37	65710	4497 Ridge Rd	0.00	0.000	0.020	6.3	37.5	711	0.001	12.75	0.01	0.07
38	65328	BARGER	0.00	0.000	0.008	11.9	66.4	758	0.002	9.63	0.01	0.09
40	66006	1708 E. Kingscreek	8.09	0.000	0.003	10.5	34.2	763	0.002	9.71	0.01	0.05
42	66071	WHITE	0.00	0.000	0.002	8.1	37.1	759	0.002	13.09	0.01	0.05
43	65816	141 E St Rt 296	9.14	0.000	0.000	13.8	40.6	917	0.000	11.04	0.02	0.08
45	65930	FREDERICK	4.58	0.001	0.005	15.0	55.0	799	0.002	11.46	0.01	0.05
47	65968	SOMMERS	3.40	0.000	0.002	26.8	119.0	1061	0.184	7.40	0.01	0.08
51	65934	BAILEY	0.00	0.000	0.433	1.3	6.0	725	0.006	16.37	0.01	0.05
53	65933	1755 N Rt 560	0.00	0.000	0.030	8.7	59.0	745	0.005	13.96	0.01	0.07
54	66002	1456 River Rd.	2.94	0.000	0.000	11.8	78.3	855	0.001	9.68	0.01	0.07
55	65931	STICKLEY	0.00	0.000	0.036	23.8	157.5	1024	0.004	14.31	0.01	0.65
56	66010	CRAIG	7.22	0.000	0.000	19.7	44.5	766	0.001	9.88	0.01	0.15
57	65945	EARNHART	0.00	0.000	0.088	7.1	55.6	756	0.001	13.41	0.01	0.07
58		201 Fulton St										
61	66075	OH VALLEY FARMS	0.00	0.000	0.000	4.7	43.1	761	0.001	13.68	0.01	0.06
64	65939	3315 W Rt 36	0.00	0.000	0.047	8.1	73.8	798	0.002	6.97	0.01	0.57
65	66079	MAYSE	5.75	0.000	0.000	9.3	34.6	774	0.001	11.39	0.01	0.05
66	66012	1855 St Rt 55	4.98	0.000	0.000	32.1	37.0	893	0.002	11.65	0.01	0.05
67	65941	1510 St Rt 55	3.85	0.000	0.000	34.1	39.0	880	0.001	12.36	0.01	0.05

Appendix C

Date 9/94

NPS ID	NAME	NO23	NO2	NH3	CL	SO4	COND	SRP	SIO2	TRISCR	ALASCAR
RS1	River Sample	3.38	0.000	0.037	12.1	37.6	625	0.001	8.17	0.01	0.07
RS2	River Sample	3.88	0.000	0.023	15.2	55.6	723	0.003	9.26	0.02	0.35
RS3	River Sample	4.57	0.013	0.050	15.2	60.2	808	0.009	9.25	0.02	0.25
RS4	River Sample	4.09	0.000	0.013	15.4	62.4	728	0.000	9.16	0.01	0.23
1	5025 Rt. 166	0.00	0.000	0.033	1.3	5.6	672	0.003	10.75	0.21	0.20
3	Littleton Funeral Home	0.00	0.000	0.025	14.6	58.9	676	0.002	12.44	0.01	0.03
6	2451 St Rt 245	0.00	0.000	0.024	10.9	65.6	794	0.002	12.38	0.03	0.06
8	KENNEDY	9.51	0.000	0.023	15.0	26.3	918	0.008	9.62	0.01	0.05
9	LAPP	2.49	0.000	0.019	24.5	76.2	796	0.002	11.69	0.01	0.03
10	J. DETWILER	0.00	0.000	0.024	12.2	49.9	802	0.002	9.24	0.23	0.07
11	T. DETWILER	0.22	0.091	0.018	29.8	96.6	930	0.001	9.54	0.28	0.64
12	CARNEY	4.80	0.000	0.024	19.0	36.7	748	0.002	12.55	0.01	0.03
13	MOWREY	0.00	0.000	0.020	11.2	76.4	693	0.002	11.10	0.01	0.02
18	6501 Upper Valley Pike	9.57	0.000	0.027	18.8	73.7	904	0.011	10.04	0.09	0.45
19	6709 Kanagy Rd	0.00	0.000	0.025	16.3	49.5	874	0.004	11.37	0.03	0.11
20	HAVE IT	0.06	0.000	0.022	12.5	63.6	625	0.001	10.27	0.01	0.03
21	NELSH	7.72	1.259	0.021	5.4	5.1	338	0.000	6.21	0.02	0.06
22	SCHILLIGER	0.00	0.000	0.024	4.1	28.0	727	0.003	17.07	0.17	0.13
23	126 Short Game Farm R	0.00	0.000	0.022	9.2	57.1	600	0.005	12.37	0.01	0.03
24	850 Lippencott Rd	0.05	0.000	0.021	4.1	19.2	726	0.001	13.62	0.11	0.25
25	TULLIS	0.00	0.000	0.027	8.8	42.6	720	0.002	13.79	0.01	0.03
26	2273 Lippencott Rd	0.00	0.000	0.125	1.7	0.8	687	0.007	15.78	0.01	0.04
27	FINCH										
28	5601 Church Rd										
29	4861 W St Rt 29	0.00	0.000	0.340	1.5	5.2	671	0.001	14.88	0.01	0.02
33	BROWN	0.67	0.000	0.023	12.7	149.3	903	0.001	9.55	0.01	0.05
34	ROUSH	0.00	0.000	0.029	21.3	116.1	752	0.001	13.39	0.09	0.09
34A	SMITH/TOLLEY	3.13	0.015	0.021	15.6	64.7	803	0.002	8.81	0.01	0.04
37	4497 Ridge Rd	0.00	0.000	0.020	6.6	29.7	729	0.001	12.63	0.01	0.02
38	BARGER	0.00	0.000	0.037	12.3	58.9	774	0.003	9.73	0.01	0.05
40	1708 E. Kingscreek	7.68	0.000	0.020	9.8	133.1	754	0.001	13.62	0.11	0.25
42	WHITE	0.00	0.000	0.031	8.1	30.7	743	0.003	13.35	0.02	0.02
43	141 E St Rt 296	9.25	0.000	0.013	14.0	27.8	905	0.001	11.05	0.01	0.04
45	FREDERICK	4.86	0.000	0.016	14.2	46.1	641	0.001	11.56	0.01	0.04
47	SOMMERS	1.82	0.000	0.020	26.5	26.4	960	0.000	7.59	0.01	0.04
51	BAILEY	0.07	0.093	0.306	1.2	-3.5	731	0.011	16.02	0.02	0.03
53	1755 N Rt 560	0.00	0.000	0.037	8.5	50.7	632	0.002	13.87	0.02	0.02
54	1456 River Rd.										
55	STICKLEY	0.00	0.000	0.034	23.7	156.2	1007	0.002	14.15	0.02	0.51
56	CRAIG	5.48	0.000	0.013	19.9	49.2	827	0.000	10.14	0.02	0.03
57	EARNHART	0.00	0.000	0.068	7.0	49.1	774	0.001	13.57	0.02	0.02
58	201 Fulton St										
61	OH VALLEY FARMS	0.00	0.000	0.088	4.8	28.1	692	0.001	13.05	0.02	0.03
64	3315 W Rt 36	0.00	0.000	0.304	10.1	68.5	812	0.001	6.95	0.01	0.43
65	MAYSE	5.19	0.000	0.018	8.7	26.3	623	0.001	11.77	0.01	0.04
66	1855 St Rt 55	4.50	0.000	0.020	32.1	29.3	880	0.001	11.46	0.01	0.04
67	1510 St Rt 55	3.80	0.000	0.022	34.5	33.1	803	0.000	12.28	0.01	0.03
70	589 Jackson Hill Rd	3.04	0.000	0.016	13.5	43.3	776	0.001	12.00	0.02	0.03
71	661 Jackson Hill Rd	0.00	0.000	0.024	23.8	30.1	780	0.001	14.37	0.06	0.13
72	681 Jackson Hill Rd	2.18	0.000	0.021	13.1	40.4	819	0.000	12.08	0.02	0.02

Appendix C

Date 3/14/94

NPS	ID	NAME	NO23	NO2	NH3	CL	SO4	COND	SRP	SIO2	TRISCR	ALASCAR
RS1	65303	River Sample	3.11	0.033	0.080	12.9	48.7	582	-0.004	6.65	0.02	0.02
RS2	65190	River Sample	3.67	0.036	0.083	13.7	61.5	587	-0.007	7.03	0.03	0.18
RS3	63856	River Sample	4.83	0.032	0.079	13.9	65.4	595	-0.007	7.89	0.03	0.21
RS4	65320	River Sample	3.88	0.000	0.086	14.2	77.7	591	-0.002	7.36	0.03	0.23
3	63169	Littleton Funeral Home	0.00	0.000	0.087	14.0	67.5	700	-0.005	12.39	0.04	0.02
6	65567	2451 St Rt 245	0.00	0.024	0.078	11.2	78.9	652	-0.005	12.82	0.01	0.03
8	63796	KENNEDY	10.32	0.026	0.087	15.6	39.5	771	0.019	9.80	0.03	0.03
9	65838	LAPP	3.53	0.026	0.079	25.6	87.1	743	-0.005	12.04	0.01	0.02
10	53347	J. DETWILER	4.88	0.069	0.564	12.5	58.7	684	-0.004	6.63	0.01	0.03
11	65305	T. DETWILER	5.62	0.025	0.086	25.7	77.4	733	-0.004	8.14	0.03	0.45
12	63130	CARNEY	4.77	0.025	0.083	18.2	51.0	705	-0.005	13.35	0.02	0.03
13	64589	MOWREY	0.00	0.024	0.091	10.2	91.0	624	-0.005	10.83	0.01	0.02
18		6501 Upper Valley Pike										
19	64372	6709 Kanagy Rd	10.86	0.027	0.084	16.9	54.9	742	-0.003	12.02	0.01	0.08
21	55463	NELSH	0.07	0.041	7.152	3.7	15.6	220	0.829	4.59	0.06	0.04
22	64590	SCHILLIGER	0.05	0.025	0.071	4.2	39.2	506	-0.004	17.91	0.01	0.03
23	63873	126 Short Game Farm Rd	0.00	0.025	0.087	8.9	69.5	638	-0.003	12.08	0.01	0.02
24	65870	850 Lippencott Rd	0.63	0.027	0.081	4.3	33.3	611	-0.003	14.10	0.01	0.02
25	65837	TULLIS	0.04	0.024	0.086	8.3	54.7	623	-0.007	14.42	0.02	0.03
26	61680	2273 Lippencott Rd	0.00	0.024	0.117	2.8	14.2	495	-0.004	16.07	0.02	0.02
27	48298	FINCH	0.04	0.023	0.114	4.7	40.5	570	0.001	13.45	0.02	0.04
28	63772	5601 Church Rd	0.04	0.025	0.079	7.2	60.4	829	0.019	18.53	0.01	0.02
29	63566	4861 W St Rt 29	0.00	0.027	0.228	1.4	18.1	568	-0.002	12.17	0.03	0.03
30		5965 Calland Rd										
33	64150	BROWN	0.00	0.024	0.074	13.1	149.2	777	-0.004	9.85	0.01	0.05
34A	64216	SMITH/TOLLEY	5.20	0.043	0.081	15.9	70.1	674	-0.004	9.25	0.01	0.04
34	50844	ROUSH	0.05	0.025	0.094	19.7	127.5	790	-0.003	13.95	0.01	0.03
37	65695	4497 Ridge Rd	0.00	0.024	0.090	6.2	43.9	593	-0.007	13.14	0.02	0.02
38	42406	BARGER	0.04	0.023	0.091	12.2	68.7	639	-0.007	9.91	0.02	0.04
42	63552	WHITE	0.04	0.024	0.085	7.4	41.9	635	-0.007	13.69	0.02	0.02
43	64963	141 E St Rt 296	9.18	0.032	0.079	12.9	43.9	793	-0.005	11.82	0.02	0.02
45	63780	FREDERICK	4.98	0.025	0.078	14.9	54.2	590	-0.003	11.50	0.01	0.03
47	45657	SOMMERS	3.39	0.027	0.085	26.6	114.1	796	-0.004	7.46	0.01	0.05
51		BAILEY										
53	65891	1755 N Rt 560	0.04	0.024	0.074	8.2	52.8	634	-0.004	14.41	0.01	0.03
54	63648	1456 River Rd.	4.33	0.024	0.088	11.2	75.0	682	-0.003	9.64	0.01	0.02
55	48971	STICKLEY	0.00	0.024	0.085	22.6	167.7	841	-0.003	14.52	0.01	0.52
56	48291	CRAIG	7.23	0.026	0.082	20.2	51.6	633	-0.004	10.22	0.01	0.02
57	65864	EARNHART	0.00	0.024	0.098	7.0	62.9	650	-0.006	14.30	0.02	0.02
58		201 Fulton St										
61	48298	OH VALLEY FARMS	0.04	0.023	0.114	4.7	40.5	570	0.001	13.45	0.02	0.04
64	48287	3315 W Rt 36	0.00	0.025	0.082	8.3	78.4	632	-0.004	7.46	0.03	0.31
65	52426	MAYSE	5.61	0.024	0.083	8.2	38.7	571	-0.006	12.03	0.02	0.04
66	53823	1855 St Rt 55	4.81	0.025	0.081	31.8	39.2	741	-0.006	11.98	0.01	0.03
67	48186	1510 St Rt 55	3.69	0.025	0.090	33.6	42.4	731	-0.007	12.69	0.02	0.03

Appendix C

DATE 12/94

NPS	ID	NAME	NO23	NO2	NH3	CL	SO4	COND	SRP	SIO2
RS1		River Sample	3.25	0.000	0.020	11.4	39.0	664	-0.002	8.42
RS2		River Sample	3.74	0.095	0.022	14.0	62.3	737	0.042	9.71
RS3		River Sample								
RS4		River Sample								
1		5025 Rt. 166	0.00	0.000	0.103	1.2	22.6	586	0.001	10.90
3		Littleton Funeral Home	0.00	0.000	0.014	13.8	69.4	693	-0.002	12.25
6		2451 St Rt 245	0.00	0.000	0.016	11.2	76.5	639	-0.002	12.76
8		KENNEDY	9.01	0.000	0.012	15.3	21.0	814	-0.002	8.38
9		LAPP	1.41	0.000	0.015	24.4	85.7	818	-0.002	11.29
10		J. DETWILER	9.21	0.000	0.011	11.9	63.5	726	-0.002	9.48
11		T. DETWILER	1.32	0.000	0.057	26.5	120.6	843	0.001	9.52
12		CARNEY	4.15	0.000	0.009	18.3	40.8	774	-0.002	12.87
13		MOWREY	0.00	0.000	0.049	10.7	87.3	756	0.001	11.17
18		6501 Upper Valley Pike	0.00	0.000	0.192	16.7	72.9	716	0.116	9.52
19		6709 Kanagy Rd	6.63	0.000	0.015	17.2	60.2	686	-0.002	11.59
20		HAVE IT								
21		NELSH	6.57	3.631	0.232	5.4	7.5	310	1.244	6.39
22		SCHILLIGER	0.00	0.000	0.044	4.0	31.5	664	-0.002	17.20
23		126 Short Game Farm R	0.00	0.000	0.031	10.0	66.1	555	0.001	12.23
24		850 Lippencott Rd	0.87	0.000	0.017	3.8	23.9	659	-0.002	13.86
25		TULLIS	0.00	0.000	0.024	8.8	43.7	644	-0.002	14.23
26		2273 Lippencott Rd	0.00	0.000	0.144	1.2	7.3	573	0.019	16.13
27		FINCH								
28		5601 Church Rd	0.00	0.000	0.014	3.7	46.3	848	0.002	18.04
29		4861 W St Rt 29	0.00	0.000	0.446	1.3	13.9	551	0.000	15.37
33		BROWN	0.72	0.000	0.010	12.5	111.2	759	-0.002	9.69
34		ROUSH	0.00	0.000	0.091	20.0	125.5	842	0.003	12.86
34A		SMITH/TOLLEY								
37		4497 Ridge Rd	0.00	0.000	0.023	6.6	8.4	643	-0.001	12.54
38		BARGER	0.00	0.000	0.029	13.6	65.1	675	0.003	9.87
40		1708 E. Kingscreek	8.86	0.000	0.017	10.9	18.5	685	0.004	9.98
42		WHITE	0.00	0.000	0.017	8.1	36.1	683	0.000	13.25
43		141 E St Rt 296	9.05	0.000	0.018	13.3	19.1	820	0.002	11.37
45		FREDERICK	4.85	0.000	0.021	13.9	47.4	714	-0.001	11.50
47		SOMMERS	1.05	0.000	0.014	27.4	119.0	775	-0.002	7.63
51		BAILEY	0.00	0.000	0.420	0.8	2.0	659	0.020	16.31
53		1755 N Rt 560	0.00	0.000	0.028	24.5	57.6	647	0.001	14.06
54		1456 River Rd.								
55		STICKLEY	0.00	0.000	0.102	23.9	111.2	911	-0.002	14.30
56		CRAIG	3.74	0.000	0.015	21.0	63.7	719	-0.002	10.21
57		EARNHART	0.00	0.000	0.067	7.5	65.2	675	0.000	13.76
58		201 Fulton St								
61		OH VALLEY FARMS								
64		3315 W Rt 36	0.00	0.000	0.049	7.2	75.4	681	-0.001	7.03
65		MAYSE	5.10	0.000	0.015	8.7	4.6	680	-0.002	11.83
66		1855 St Rt 55	2.67	0.000	0.148	26.6	14.8	673	0.001	10.30
67		1510 St Rt 55	4.02	0.000	0.027	34.1	25.0	781	0.000	12.38
70		589 Jackson Hill Rd	2.49	0.000	0.023	12.6	35.7	640	-0.002	12.24
71		661 Jackson Hill Rd								
72		681 Jackson Hill Rd	1.26	0.000	0.030	11.6	34.7	666	-0.002	10.94

Appendix C

DATE 3/95

NPS ID	NAME	NO23	NO2	NH3	CL	SO4	COND	SRP	SIO2
RS1	River Sample	3.13	0.003	0.012	15.6	66.1	631	0.000	7.69
RS2	River Sample	3.68	0.001	0.014	16.8	76.4	676	0.000	7.84
RS3	River Sample	4.34	0.000	0.007	16.4	84.3	643	0.000	7.85
RS4	River Sample	4.34	0.002	0.012	17.7	94.1	694	0.000	7.74
1	5025 Rt. 166	0.00	0.000	0.128	1.6	27.5	436	0.000	10.82
3	Littleton Funeral Home	0.15	0.000	0.027	16	66.4	849	0.000	12.14
6	2451 St Rt 245	0.00	0.000	0	11.8	78.2	636	0.000	12.68
8	KENNEDY								
9	LAPP	0.96	0.000	0.013	23.8	87.2	723	0.000	11.33
10	J. DETWILER	8.89	0.058	0.027	13.3	60.5	713	0.000	8.52
11	T. DETWILER	2.03	0.000	0.018	23.9	134.2	642	0.000	8.64
12	CARNEY	3.72	0.000	0.025	18	55.6	649	0.000	12.78
13	MOWREY	0.00	0.000	0.015	11.6	86.5	640	0.000	10.98
18	6501 Upper Valley Pike	9.86	0.000	0.02	19.1	81.7	733	0.000	10.24
19	6709 Kanagy Rd	6.63	0.000	0.016	16.7	67	585	0.000	11.88
20	1409 East Kanagy Rd								
21	NELSH								
22	SCHILLIGER	0.00	0.000	0.015	4.9	40.1	659	0.000	23.55
23	126 Short Game Farm R	0.00	0.000	0.022	11.8	73.7	665	0.000	11.8
24	850 Lippencott Rd	0.98	0.000	0.031	4.3	38.2	581	0.000	13.48
25	TULLIS	0.00	0.000	0.016	10.4	57	582	0.000	13.8
26	2273 Lippencott Rd	0.00	0.000	0.188	2	15.4	585	0.001	15.81
27	FINCH								
28	5601 Church Rd	0.00	0.000	0.01	8.5	63.6	893	0.002	17.35
29	4861 W St Rt 29	0.00	0.000	0.493	1.9	21.1	601	0.000	15.4
33	BROWN	0.16	0.000	0.016	13	110.6	733	0.000	9.66
34	ROUSH	0.00	0.000	0.111	20.5	137.3	755	0.000	12.77
34A	SMITH/TOLLEY	0.10	0.000	0.024	12.6	67.7	702	0.000	9.22
37	4497 Ridge Rd	0.00	0.000	0.021	7.1	45.3	616	0.000	12.31
38	BARGER	0.00	0.000	0.029	17.2	68.1	613	0.000	9.31
40	1708 E. Kingscreek								
42	WHITE	0.00	0.000	0.005	8.9	43.9	601	0.005	13.15
43	141 E St Rt 296								
45	FREDERICK	4.67	0.000	0.032	15	56.5	664	0.000	11.27
47	SOMMERS	0.84	0.000	0.013	28.4	143.8	1023	0.132	7.430
51	BAILEY	0.00	0.000	0.394	1.7	15	595	0.007	16.17
53	1755 N Rt 560	0.00	0.000	0.034	8.7	61.2	583	0.000	13.56
54	1456 River Rd.	1.41	0.000	0.012	13.6	138.5	660	0.000	9.76
55	STICKLEY	0.00	0.000	0.034	22.9	190.6	658	0.000	14.02
56	CRAIG	2.47	0.000	0.005	22.4	71.2	629	0.000	10.15
57	EARNHART	0.00	0.000	0.058	8.4	64.6	643	0.000	13.31
58	201 Fulton St								
61	OH VALLEY FARMS	0.00	0.000	0.093	5.2	42.8	567	0.000	12.91
64	3315 W Rt 36	0.03	0.000	0.009	8.6	74.4	649	0.000	6.75
65	MAYSE	4.34	0.000	0.008	9.3	46.9	634	0.000	11.43
66	1855 St Rt 55	4.10	0.000	0.02	32.5	46.5	773	0.000	11.82
67	1510 St Rt 55	4.27	0.000	0.007	32.7	41.3	602	0.000	12.06
70	589 Jackson Hill Rd	1.69	0.000	0.007	13.5	51.8	609	0.000	12.13
71	661 Jackson Hill Rd								
72	681 Jackson Hill Rd	1.97	0.000	0.014	14	53.2	629	0.000	11.89
74	1763 Jackson Hill Rd	13.23	0.000	0.025	8.3	37.7	631	0.000	11.32

DATE 12/94 Coshocton

NPS	ADDRESS	Ph	Alk	Sc	TDS	SO4	CL	CA	MG	NA	K	FE	MN	AL	HARD	NO23
8	Kennedy	6.90	290	728	510	30.0	8.70	0.39	0.55	180.00	0.49	0.02	0.03	0.10	30	9.20
10	Detwiler	6.99	261	733	470	46.5	15.10	39.00	44.00	4.84	1.67	0.01	0.01	0.10	412	11.30
11	Detwiler	6.95	260	847	490	102.0	26.80	53.10	50.60	11.00	2.47	0.03	0.04	0.10	472	1.40
19	6709 Kanagy	6.80	299	800	450	73.0	10.30	95.00	38.50	7.70	2.74	0.02	0.10	0.10	460	7.00
21	Nelsh	6.70	108	285	125	5.0	9.60	27.90	8.30	4.97	13.40	0.03	0.02	0.10	152	2.15
25	Tullis	7.00	272	688	370	58.0	8.40	29.00	44.40	3.65	1.28	0.02	0.10	0.10	416	0.21
33	Brown	6.75	275	724	550	148.0	14.80	103.00	47.70	7.10	1.77	0.01	0.19	0.10	480	0.90
40	1708 East Kingscreek	7.02	219	673	375	28.0	13.80	35.40	30.60	4.20	2.29	0.01	0.01	0.10	392	8.40
47	Sommers	6.72	280	869	575	140.0	27.70	121.00	42.40	12.10	2.64	0.01	0.01	0.10	476	1.30
53	1755 N. Rt. 560	7.09	299	699	360	60.0	10.60	86.00	34.20	7.10	1.10	0.01	0.05	0.10	384	0.10
55	Stickley	6.99	224	910	640	183.0	23.90	110.00	40.80	2.90	1.23	0.02	0.34	0.10	508	0.10
56	Craig	7.31	280	760	395	62.0	23.40	88.00	32.80	6.80	1.58	0.02	0.01	0.10	424	4.00
65	Mayse	7.10	273	675	340	50.0	10.00	65.00	39.50	9.60	1.82	0.01	0.01	0.10	390	5.20
RS1	River Sample	7.50	270	671	400	30.0	14.50	76.00	30.60	7.90	2.10	0.05	0.01	0.10	376	3.50
RS2	River Sample	7.35	270	687	405	61.0	18.70	87.00	35.20	8.40	2.07	0.01	0.01	0.10	412	3.60
RS3	River Sample	7.51	199	716	290	75.0	17.00	50.00	33.10	6.70	2.40	0.02	0.07	0.10	364	4.40
RS4	River Sample	7.49	229	693	395	90.0	17.50	86.00	33.90	7.60	1.95	0.01	0.01	0.10	440	3.90

Appendix D

3/95

DATE [redacted] Coshocton

NPS	ADDRESS	Ph	Alk	Sc	TDS	SO4	CL	CA	MG	NA	K	FE	MN	Al	HARD	NO23
8	Kennedy															
10	Detwiler	7.41	307	733	404	60	16	90	43.9	5.3	1.4	0.03	0.01	0.1	417	13.3
11	Detwiler	7.6	321	820	600	117	25	107	51	8.8	1.83	0.02	0.01	0.1	460	2.75
19	6709 Kanagy	7.42	352	795	524	65	16	100	46.3	5.7	2.59	0.01	0.01	0.1	440	8.71
25	Tullis	7.41	341	691	388	54	10	92	41	3.73	1.14	0.04	0.09	0.1	389	0.1
38	Barger	7.55	285	660	416	78	20	89	39.3	5.2	1.73	0.24	0.4	0.1	377	0.1
39	1992 Kennard Kingsc	7.25	436	904	528	17	18	110	43.7	14	5.5	0.01	0.01	0.1	500	8.7
41	3881 Clark Road	7.41	391	860	524	25	20	90	48.2	9.3	2.27	0.02	0.01	0.1	464	14.2
42	White	7.69	331	675	360	42	10	85	40.1	4	1.5	0.85	0.07	0.1	380	0.1
44	2989 Rt. 68	7.61	319	731	416	29	17	48	41.2	6.2	1.23	0.01	0.01	0.1	393	12
47	Sommers	7.65	349	956	576	125	28	0.48	0.12	245	0.59	0.01	0.01	0.1	12	1.39
53	1755 N. Rt. 560	7.85	317	680	408	59	14	92	40.8	6.2	1.01	0.12	0.03	0.1	393	0.2
55	Stickley	7.51	327	911	644	165	23	156	37.5	3.29	1.07	0.33	0.35	0.1	507	0.275
56	Craig	7.58	320	750	432	70	24	101	44.6	5.9	1.55	0.01	0.01	0.1	405	3.55
65	Mayse	7.52	315	679	396	32	17	85	38.8	8	1.59	0.02	0.01	0.1	365	6.55
RS1	River Sample	7.41	296	689	412	68	17	87	38.2	7.3	1.97	0.04	0.04	0.1	377	3.69
RS2	River Sample	7.49	297	721	408	76	18	99	39.1	7.2	1.92	0.02	0.03	0.1	400	4.49
RS3	River Sample	7.6	298	739	432	90	18	103	39.9	6.5	1.85	0.04	0.04	0.1	424	5.71
RS4	River Sample	7.6	321	820	600	117	25	107	51	8.8	1.83	0.02	0.01	0.1	460	2.75

Appendix D